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This report was prepared by Joseph Rosenthal under the general supervision of Dr. Herbert H. Rosenberg, Chief, Resources Analysis Branch, Office of Program Planning. The National Institutes of Health wishes to acknowledge the cooperation of Federal agencies whose assistance in supplying the detailed information made this report possible.

RESOURCES
for MEDICAL RESEARCH

Resources Analysis Branch, Office of Program Planning
National Institutes of Health
Bethesda 14, Maryland

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FOREWORD

The expansion of medical research in recent years, largely a result of increased Federal support, places upon the Public Health Service and other agencies a heavy responsibility for forward planning and effective administration. This responsibility is not confined to the conduct and support of current research projects. It calls for careful measurement of the resources presently available for this purpose—funds, personnel, facilities, and institutions—as well as those necessary for the future.

Continuing study of resources for medical research is a part of the function of the National Institutes of Health, the Service's main research constituent. The activity is centered in the Office of Program Planning.

The present publication is the first of a series of reports analyzing aspects of the medical research effort which are of widespread interest. This report presents a broad picture of Federal expenditures for medical research and the construction of research facilities, data for which were collected by the National Institutes of Health at the request of the Bureau of the Budget. Summary data derived from this survey have been published in the *Budget of the United States Government, Fiscal Year 1963*.

Federal support for these activities totaled \$850 million in fiscal 1962. Of this total, \$620 million, nearly three-quarters, was awarded in grants and contracts; and \$545 million of that went to the Nation's educational and other nonprofit institutions.

Subsequent reports in this series will deal with manpower, trends in private support for medical research, and other topics of broad interest to persons concerned with the planning, direction, and productivity of programs in the health sciences.

LUTHER L. TERRY
Surgeon General,
U.S. Public Health Service

FEDERAL EXPENDITURES FOR MEDICAL AND HEALTH-RELATED RESEARCH 1960-63

PURPOSE AND SCOPE

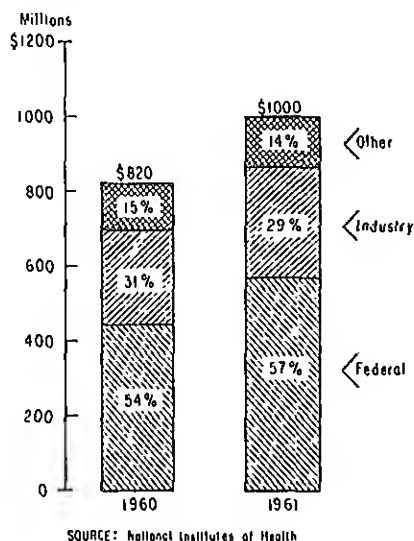
This *Report* is the first of a series designed to present timely information on significant measures of the Nation's resources devoted to medical and health-related research. Last year the Nation's expenditures for the performance of such research reached \$1 billion, and the Federal Government financed more than 55 percent of this national effort (chart 1). This publication provides a comprehensive picture of Federal expenditures for medical and health-related research for fiscal years 1960-1962, and a brief summary of such expenditures proposed in the President's Budget for fiscal 1963. Subsequent reports will focus on other equally vital facets of the Nation's research resources—funds, manpower, facilities, and institutions—dedicated to the improvement of health and the conquest of disease.

The data presented here on Federal expenditures for medical research in 1961-62 were obtained from Federal agencies by the National Institutes of Health pursuant to a request from the Bureau of the Budget. Estimates for fiscal year 1963 were submitted to the Bureau of the Budget and made available for purposes of analysis to the National Institutes of Health. To ensure complete and consistent coverage, the survey included and differentiated between expenditures for (1) medical and health research budgeted and justified as such and (2) research directly related to health but supported and justified for other purposes, such as the promotion of agriculture, the development of atomic energy, and the exploration of space. Federal expenditures for the construction of facilities for medical and health-related research are included in the discussion, but the support provided for the training of research manpower will be covered in later reports. (See *Note on Definitions and Method*)

The analysis focuses on the more recent trends in Federal expenditures for medical and health-related research, the relationship between these outlays and total Federal expenditures for research and development in all fields, the distribution of support among Federal agencies, including a brief discussion of the agencies' health-related research missions, and the distribution of the Federal medical and health-related research dollar by performer and by field of science.

Chart 1

National Expenditures for Performance of Medical and Health-Related Research, 1960-61



HIGHLIGHTS

1. Federal expenditures will exceed \$850 million in 1962 for the performance of medical and health-related research and the construction of health research facilities. The 1963 estimate rises above \$1 billion, reflecting increases proposed in the President's Budget.

2. Between 1960 and 1962, Federal outlays for these activities increased more than \$350 million—almost 75 percent. Paralleling this rising support for medical research, Federal research expenditures not oriented to defense needs or space exploration also increased by 70 percent during the same period.

3. The Federal Government now invests 8 cents of its R & D dollar for medical and health-related research and for health research facilities. This proportion has been rising in recent years.

4. Of the \$850 million total in 1962, more than 90 percent, or \$790 million, covers the cost of performing medical and health-related research. The remainder, almost \$70 million, represents capital outlays for the expansion of health research facilities.

5. Eighty percent of the \$790 million spent by Federal agencies for the conduct of medical and health-related research is budgeted and justified

health but supported as germane to agency research missions other than health.

6. Nearly three-fourths of the Federal medical and health-related research performance dollar—\$580 million—is spent through grants or contracts to other research performers, largely universities and other nonprofit institutions. One-fourth—\$210 million—finances research conducted in Federal laboratories and hospitals.

7. Educational and other nonprofit institutions will receive more than \$500 million this year from Federal agencies for medical and health-related research—more than 85 percent of all Federal grant and contract funds spent for this research activity; and \$40 million will finance such research in industry. An additional \$20 million will be spent for research performed for the United States in laboratories and research institutes in foreign countries.

8. Ninety percent of federally supported medical research is concentrated in the many disciplines of biology and medicine. Ten percent—\$80 million—is distributed broadly among related fields in the psychological, physical (including mathematics and engineering), and social sciences.

9. Forty percent of the \$70 million investment in facilities for research will cover the costs of new build-

for expanding health research facilities at educational institutions, hospitals, or other nonfederal centers.

ANALYSIS

Trends in Federal Expenditures for Medical and Health-Related Research

Federal agencies will spend more than \$850 million this year for medical and health-related research facilities, as compared with nearly \$500 million in 1960.¹ The \$350 million increment represents

¹ Expenditure data in this Report refer to the obligations of Federal agencies for medical and health-related research. Data for 1960 and 1961 are actual obligations; data for 1962 and 1963 are agency estimates of amounts to be obligated this year. They reflect administrative decisions on apportionment of fiscal appropriations for 1962; estimates for 1963 are based on the requests in the President's Budget for 1963, submitted to Congress in January 1962. Statistics for earlier years are Federal expenditures for medical and health-related research, but are not comparable with the 1960-1963 data presented in this Report. The earlier series provides inadequate coverage of research directly related to health but supported by the agency's mission. This underreporting is particularly significant for the medical and health-related research classified in fields of science other than medicine. The series for earlier years will be revised as soon as possible.

Table 1
Federal Expenditures for Medical and Health-Related Research, 1960-62
(Millions of dollars)

Item	1962 (estimate)	1961 (actual)	1960 (actual)	Increase 1962/1960	
				Amount	Percent
Total	\$857	\$623	\$494	\$363	
Budgeted	706	503	391	315	
Directly related	151	120	103	48	
Conduct of research	790	570	444	346	
Budgeted	650	459	350	300	
Directly related	140	111	94	46	
Expansion of research facilities	68	53	50	18	
Budgeted	56	44	41	15	
Directly related	12	9	9	3	

Note.—Detail will not necessarily add to totals because of rounding.

SOURCE: National Institutes of Health.

a 75 percent increase above the 1960 level and is roughly consistent with the long-term growth rate for Federal support of medical research.

Within the total for 1962, it is estimated that \$790 million will be spent for the conduct of research and about \$70 million for the expansion of health research facilities. Between 1960 and 1962, however, rising expenditures for conduct of research were not accompanied by increases in Government investment in research facilities (chart 2). Chart 2 indicates that outlays for health research facilities declined proportionately from 10 percent of the total in 1960 to 8 percent in 1962. To redress this growing imbalance, the President's Budget for 1963 proposes more than a 50 percent increase for new research facilities, as compared with a 16 percent increase in expenditures for the conduct of medical and health-related research (table 2).

Relation to Total Federal R & D

Federal expenditures for all research and development in all fields (including outlays for facilities) will total almost \$11 billion in 1962.² This represents an

² Based on obligations for research and development reported in the National Science Foundation's *Federal Funds for Science X*, NSF 61-82: actual data for fiscal 1960, estimated data for 1961 and 1962, but adjusted to reflect congressional appropriations and apportionment for 1962.

Chart 2

Federal Expenditures for Medical and Health-Related Research, 1960-62

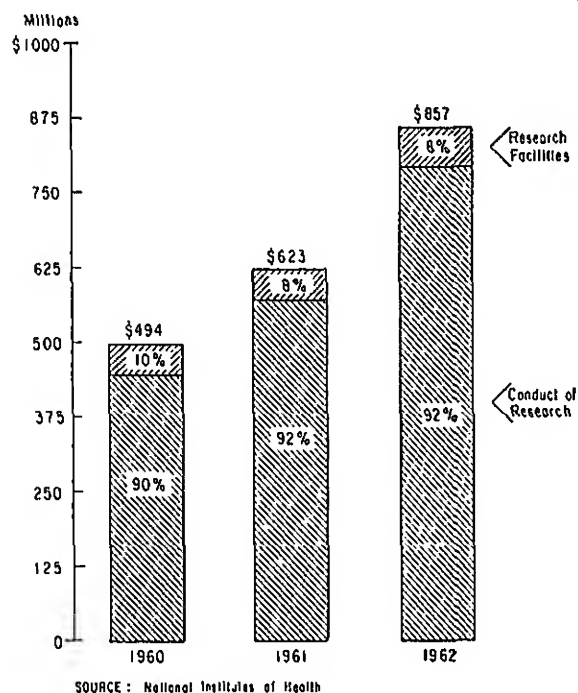


Table 2

Federal Expenditures for Medical and Health-Related Research, 1962-63

[Millions of dollars]

Item	1963 (estimate)	1962 (estimate)	Increase 1962-63	
			Amount	Percent
Total.....	\$1,024	\$857	\$167	19.5
Budgeted.....	843	706	137	19.4
Directly related.....	181	151	30	19.9
Conduct of research.....	920	790	130	16.5
Budgeted.....	750	650	100	15.4
Directly related.....	169	140	29	20.7
Expansion of research facilities.....	104	68	36	52.9
Budgeted.....	93	56	37	66.1
Directly related.....	11	12	-1	-8.3

Note.—Detail will not necessarily add to totals because of rounding.

SOURCE: National Institutes of Health.

the \$8 billion total for 1960 (table 3).

The support provided in this period to broad program areas has differed (chart 3).

Outlays for research for national defense (Defense Department and AEC) which constitute the largest research program—70 percent of total Federal R & D—have increased less than one-fifth since 1960. Research expenditures for space exploration (programs administered by the National Aeronautics and Space Administration) have mounted more rapidly than other Federal programs; space research now comprises 15 percent of all Federal R & D, as compared with 6 percent in 1960. In the same period, medical and health-related research has grown from 6 percent of all Federal R & D to 8 percent.

It should be noted, however, that expenditures for other nonmilitary research programs have risen about as rapidly as growing Federal support for medical research (chart 3). Considered as a group, the support provided for all other Federal programs increased 68 percent between 1960 and 1962, slightly less than the 73 percent gain for medical research. Outlays for these other Federal research programs now account for 6 percent of all Federal R & D, as compared with less than 5 percent in 1960. Substantial added funds have been provided for the support of basic research through grants administered by the National Science Foundation and for growing research activities in agriculture, civilian aviation, labor, and commerce.

For most agencies, the medical and health-related component accounts for only a relatively small share of the agency's research budget (table 4). At the

and the National Institutes of Health, where 100 percent of the research activities are medical and health-related. At the opposite extreme are the Department of Defense and the National Aeronautics and Space Administration, where such activities represent only one percent of agency research expenditures, although the small percentage in each instance reflects sizable sums for the health research picture. In the middle range are still other agencies such as the Department of Agriculture with 13 percent, the National Science Foundation with 11 percent, and the Atomic Energy Commission with 7 percent.

Medical Research Missions of Federal Agencies

The national interest in medical research has evolved gradually over the past century. Eighty years ago, the Congress created a National Board of Health in 1879 following a severe yellow fever epidemic, when it became clear that existing means were inadequate for controlling communicable disease of this nature. Among its many productive activities, the Board initiated a research program that provided financial aid to scientists at universities through grants for research on problems of interest to the Board. This was perhaps the first use of the Federal grant-in-aid device for the support of research in nonfederal institutions.³

³ For a more extensive discussion of the historical evolution of the Federal role in medical research, see Shannon, James A., "The Development of the Federal Role in the Support of Medical Research," *Bulletin of the New York Academy of Medicine*, second series, vol. 37, No. 1, pp. 3-14, Jan. 1961.

Table 3
Federal Expenditures for Research and Development, by Program Area, 1960-62
(Millions of dollars)

Program area	1962 (estimate)		1961 (estimate)		1960 (actual)		Ratio 1962-60
	Amount	Percent	Amount	Percent	Amount	Percent	
Total Federal research and development.....	\$10,804	100.0	\$9,829	100.0	\$8,075	100.0	1.3
National defense (Defense Dept. and AEC) ¹	7,734	71.6	7,721	78.6	6,717	83.2	1.2
Space exploration (NASA) ¹	1,579	14.6	995	10.1	486	6.0	3.2
All other Federal.....	1,491	13.8	1,113	11.3	872	10.8	1.7
Medical and health-related.....	857	7.9	623	6.3	494	6.1	1.7
Other.....	634	5.9	490	5.0	378	4.7	1.7

¹ Excludes medical and health-related research.

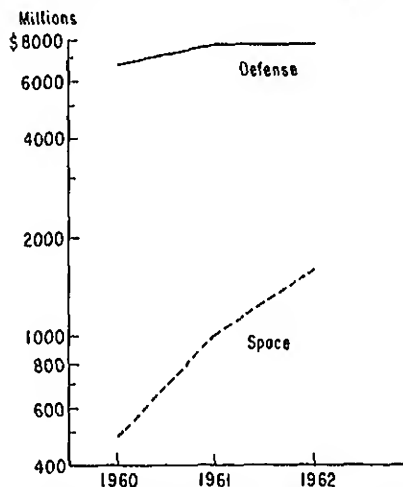
SOURCES: National Institutes of Health and National Science Foundation.

Trends in Federal R & D Expenditures, 1960-62

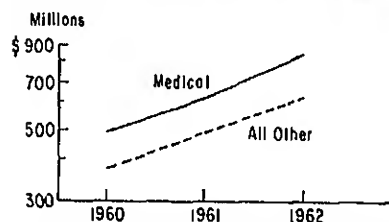
FEDERAL EXPENDITURES FOR ALL R & D HAVE INCREASED ABOUT 1/3 SINCE 1960;



BUT THIS EXPANSION HAS BEEN UNEVEN—DEFENSE RESEARCH HAS GROWN LESS THAN 1/5, SPACE RESEARCH* HAS EXPANDED OVER 2 TIMES.



ON THE OTHER HAND, MEDICAL AND ALL OTHER RESEARCH HAVE GROWN AT ABOUT THE SAME RATE—7/10



* National Aeronautics and Space Administration only.
Sources: National Science Foundation and National Institutes of Health.

The center of Federal medical research later shifted to the War Department. Here, a small and gifted group of men under the leadership of Sternberg and the influence of Dr. John Shaw Billings, who had been vice-chairman of the National Board of Health, began a period of research sparked by the developments in bacteriology emanating from Europe in the work of Pasteur and Koch. Their intensive work on yellow fever culminated in the dramatic achievements of Reed and Gorgas.

In 1887 the Hygienic Laboratory, of which the National Institutes of Health is the genealogical descendant, was established. This one-room laboratory later expanded into a research organization with separate divisions of chemistry, bacteriology, pathology, zoology, and pharmacology. Its research

Health Service was specifically empowered to "study and investigate the diseases of man."

From these modest beginnings in the military establishment and the Public Health Service, Federal support of medical research has evolved to the point where it now constitutes a comprehensive and large-scale program designed to (1) improve the health and well-being of the American people, (2) combat specific diseases and health hazards, (3) provide the information required for the more effective performance of Federal agency missions, and (4) push back the frontiers of knowledge by supporting the work of scientific investigators of clear promise or demonstrated productivity. This broad-scale research effort has expanded steadily in scope and depth since World War II.

In keeping with this expansion of effort, the current measurement and definition of medical and health-related research reflect the broad scientific areas and the manifold avenues of investigation currently pursued in the search for knowledge to conquer disease and improve health. (See note on *Definitions and Method*.) Congressional support for medical and health-related research has paced and stimulated the growth of the Nation's capabilities, resources, and technical skills for research. Funds are provided not only for programs of Federal agencies whose sole research mission is the advancement of medical knowledge, and whose programs are budgeted and justified on that basis, but as already indicated, sums are also provided for research that is directly related to human health but carried on primarily in the fulfillment of an agency's broader mission.

THE CURRENT SCENE

Ten Federal agencies now share in financing the performance of medical and health-related research.

Agencies of the Department of Health, Education, and Welfare now spend over \$580 million for medical and health-related research—roughly three-fourths of total Federal funds devoted to this activity. Programs of the National Institutes of Health, a constituent agency of that department and the principal medical research agency of the Federal Government, account for nearly \$520 million—two-thirds of the Federal total (tables 5A and 5B).

Other Federal agencies also provide substantial support for medical and health-related research: the Atomic Energy Commission—\$65 million (8 percent of the Federal total); the Department of Defense—\$60 million (8 percent); the Veterans Administration—\$26 million (3 percent); \$20 million each (or 2.5 percent) by the Department of Agri-

Administration; and \$12 million (slightly over one percent) for support of basic research by the National Science Foundation. All Federal agencies with the exception of the National Science Foundation have enlarged their medical research activities since 1960. The most dramatic spurt shows in NASA's still small but rapidly growing medical research program underpinning the Nation's space exploration effort, including the successful orbital flights of astronauts Glenn and Carpenter.

In looking at Federal support for this broad spectrum of research activity, it is helpful to distinguish between (1) those programs which are budgeted and justified as medical and health-related research, both within the Executive and Legislative Branches and to the American people, and (2) equally significant research endeavors that are clearly and directly related to health but are financed because of the agency's responsibilities for the achievement of broader national purposes. In the aggregate, about 80 percent—or \$650 million—of all Federal expenditures for the conduct of medical and health-related research in

defined above. As indicated in table 5A, additional \$140 million—or 20 percent of the total represented research directly related to health, supported because of its relevance to the agency's broader missions.

In some instances, medical research budgeted and justified as such constitutes the all-inclusive research mission of the agency—e.g., Public Health Service, Veterans Administration; in other cases—such as Atomic Energy Commission, or the Department of Defense—only part of the medical and health-related research program is budgeted as such; for still other agencies, such as the Department of Agriculture or the National Aeronautics and Space Administration, the entire medical and health-related research program is undertaken to support the agency's broader mission.

Medical research programs vary substantially in content and emphasis. In the sections that follow immediately, the programs of those agencies or departments spending \$1 million or more in 1962 for the support of medical and health-related research will be described.

Table 4
Comparison between Expenditures for Conduct of Medical and Health-Related Research and Total R & D, by Agency, 1960-1962
(Millions of dollars)

Agency	1962			1961			1960		
	Total conduct of research and devel- opment	Medical and health- related research	Percent medical R & D of total R & D	Total conduct of research and devel- opment	Medical and health- related research	Percent medical R & D of total R & D	Total conduct of research and devel- opment	Medical and health- related research	Per cent of R & D
	(estimate)			(estimate)	(actual)	(esti- mate)	(actual)		
Total.....	\$9,776.3	\$789.6	8.1	\$9,119.9	\$569.6	6.2	\$7,487.2	\$443.9	
Atomic Energy Commission.....	928.8	64.7	7.0	862.6	55.7	6.5	761.7	50.3	
Federal Aviation Agency.....	68.5	1.9	2.8	66.6	1.7	2.6	47.9	.9	
National Aeronautics and Space Administration.....	1,305.0	20.6	1.6	790.4	4.8	.6	369.3	.7	
National Science Foundation.....	108.0	11.7	10.8	76.7	11.8	15.4	68.4	13.8	
Office of Emergency Planning.....	N.A.			N.A.	.5		N.A.	.4	
Veterans Administration.....	26.4	26.4	100.0	18.4	18.4	100.0	15.1	15.1	
Department of Agriculture.....	150.9	20.0	13.3	170.6	17.8	10.4	125.8	14.3	
Department of Defense.....	6,491.8	59.9	.9	6,638.7	48.0	.7	5,711.5	38.2	
Department of Health, Education, and Welfare.....	598.3	582.6	97.4	418.5	409.2	97.8	316.7	308.8	
(National Institutes of Health).....	(518.7)	(518.7)	(100.0)	(372.1)	(372.1)	(100.0)	(279.7)	(279.7)	
Department of Interior.....	82.4	.9	1.0	75.2	.9	1.2	68.3	.7	
Department of State.....	16.2	1.0	6.2	2.2	.8	36.4	2.5	.8	

Note.—Expenditures for performance of research and development of those Federal agencies having no medical and health-related research amounted to \$60 million a year in 1960 and 1961, and \$80 million in 1962.
Detail will not necessarily add to totals because of rounding.

SOURCES: Obligations for total research and development—National Science Foundation, *Federal Funds for Science and Technology*, 61-82; data for 1962 reflect congressional action and apportionment decisions on 1962 budget requests; however, data for Department of Health, Education, and Welfare and Veterans Administration were compiled by National Institutes of Health.
Obligations for medical and health-related research—National Institutes of Health.

briefly, drawing upon many sources—narrative summaries prepared by the agencies for budget submissions, testimony before congressional committees, annual reports, and direct responses to inquiries.

Distribution of Medical Research Expenditures by Agency

Federal agencies will spend in the vicinity of \$650 million in fiscal year 1962 for the conduct of medical and health-related research budgeted and supported as such. This reflects an increase of \$200 million over 1961, and raises the 1962 level about 85 percent above the 1960 base of \$350 million.

The Department of Health, Education, and Welfare currently provides three-fourths of the total Federal expenditures for the conduct of medical and health-related research and 90 percent of the medical and health-related research budgeted as such. *The National Institutes of Health*, a bureau of the Public Health Service of the Department of Health, Education, and Welfare, is charged with the primary responsibility for providing broad support for research aimed at the conquest of disease and the improvement of health. Approximately 2,500 scientists and research workers are directly engaged in medical research in the laboratories and Clinical Center on the NIH reservation at Bethesda. In addition to this direct research activity, thousands of scientists receive NIH support for their research in universities, medical schools, hospitals, research institutes, State agencies, and in foreign countries. The research activities of the National Institutes of Health are organized and conducted through seven categorical Institutes, five major Divisions, a 500-bed Clinical Center, and field activities both in the United States and abroad.

Each of the Institutes conducts or sponsors research in relation to the causes, prevention, diagnosis, and treatment of designated broad disease areas—cancer, heart, mental, dental, metabolic, infectious, and neurological. The support of basic biomedical research, and of investigations of health problems not covered by the categorical institutes, is a function of the Division of General Medical Sciences. The Division of Biologics Standards conducts research related to the development, manufacture, and testing of serums, vaccines, and other biological products for the prevention and treatment of disease.

The Bureau of State Services of the Public Health Service also supports significant medical and health-related research programs related to the application of research findings. In 1962 this Bureau will spend

tion of accidents, and the control of tuberculosis, venereal, and other communicable diseases.

In addition to the large-scale research activities of the Public Health Service, two other agencies of the Department of Health, Education, and Welfare—the Food and Drug Administration and the Office of Vocational Rehabilitation—also provide support for major medical and health-related research programs.

In 1962 the *Food and Drug Administration* will spend \$4 million on research to implement the agency's statutory responsibility for protection of consumers against adulterated and misbranded food, drugs, and cosmetics. In carrying out this mission, the agency's research activities include clinical investigations of drugs to determine their effects through controlled experimentation, development of analytical methods for use in field analyses and to develop food standards; and study of tolerances for pesticides and food additives.

The Office of Vocational Rehabilitation supports research to develop new knowledge and techniques which will aid the disabled to overcome their handicaps, and thus be restored to more productive and useful lives. Funds devoted to this purpose in 1962 approximate \$12 million.

The Veterans Administration's program of medical and health-related research is directly related to its responsibility for the provision of medical care to veterans. In 1962 the VA research program will exceed \$25 million—a 75 percent rise since 1960.

Veterans with chronic diseases requiring long-term hospital care constitute a predictable and rising patient load for VA hospitals. Consequently, VA research seeks to gain new knowledge which will extend the clinical capability of VA medical staffs in the diagnosis and treatment of medical conditions facing the veteran population in such major problem areas as heart disease, respiratory diseases, cancer, problems of aging, and neurophysiological disorders.

The small but rapidly expanding medical and health-related research program of the *Federal Aviation Agency* will approach \$2 million this year. This research aims at the identification and control of the physical, physiological, and psychological factors which may jeopardize safety in flight. It seeks to improve methods for the determination of physical fitness and increased knowledge of the capacities and limitations of the human body to withstand the constantly rising stresses of higher altitudes, pressures, and speeds.

In 1962 the Agency for International Development

to the World Health Organization research program, funds to assist the Asiatic members of SEATO in their basic medical research programs to combat cholera, and support for research tied to an international campaign aimed at the eradication of malaria.

Research Directly Related to Health

Medical and health-related research programs of two agencies with major research functions—the Department of Defense and the Atomic Energy Commission—embrace some medical and health-related projects which are budgeted and supported as such, as well as other research activities directly related to health and supported because of their relevance to broader missions of the agency.

The Atomic Energy Commission in 1962 will spend about \$7 million for medical research budgeted as such, and \$57 million for research directly related to health but supported as being necessary for the implementation of the agency's program—the develop-

its statutory responsibilities, the AEC conducts supports research projects designed to: (1) increase basic knowledge and understanding of the effects of radiation on living systems (molecular and cell level studies, radiation genetics, environmental radiation studies); (2) solve practical health and safety problems connected with atomic energy programs and devices (atmospheric radioactivity and fallout health physics, combating detrimental effects of radiation); and (3) provide the knowledge leading to the beneficial application of special nuclear radioactive materials (use of radioisotopes in medical and agricultural research, the processing of foods by radiation as a means of preservation).

AEC research programs directly related to human health account for two fifths of the \$140 million spent by Federal agencies for research directly related to human health but supported for other purposes.

The Department of Defense in 1962 will spend about \$100 million for medical and health-related research, a sum about equally divided between health research

Table 5A
Federal Expenditures for Conduct of Medical and Health-Related Research, 1960-62
(Millions of dollars)

Agency	1962			1961			1960			Increase 1960- 62 total expend- itures
	Total	Bud- geted	Directly related	Total	Bud- geted	Directly related	Total	Bud- geted	Directly related	
	(estimate)			(actual)			(actual)			
Total.....	\$789.6	\$649.9	\$139.7	\$569.6	\$459.0	\$110.6	\$443.9	\$350.2	\$93.8	\$345.7
Atomic Energy Com- mission.....	64.7	7.5	57.2	55.7	6.9	48.7	50.3	6.2	44.0	14.4
Federal Aviation Agency.....	1.9	1.9		1.7	1.7		.9	.9		1.0
National Aeronautics & Space Administration.....	20.6		20.6	4.8		4.8	.7		.7	19.9
National Science Foun- dation.....	11.7		11.7	11.8		11.8	13.8		13.8	-2.1
Office of Emergency Planning ¹.....				.5	.5		.4	.4		2-.4
Veterans Administra- tion.....	26.4	26.4		18.4	18.4		15.1	15.1		11.3
Department of Agri- culture.....	20.0		20.0	17.8		17.8	14.3		14.3	5.7
Department of Defense.....	59.9	30.5	29.4	48.0	21.5	26.5	38.2	18.0	20.2	21.7
Department of Health, Education, & Welfare (National Institutes of Health).....	582.6	582.6		409.2	409.2		308.8	308.8		273.8
Department of Interior.....	(518.7)	(518.7)		(372.1)	(372.1)		(279.7)	(279.7)		(239.0)
Department of State.....	.9		.9	.9		.9	.7		.7	.2
	1.0	1.0		.8	.8		.8	.8		.2

¹ Data for 1960 were not furnished by the Defense Department; they are derived from estimates published in *Health Research Training*, House Committee on Government Operations, House Report No. 321, 87th Congress 1st Session, April 28, 1961, p. 1.

² Medical research activities merged with Defense Department in 1962.

Note.—Detail will not necessarily add to totals because of rounding.

SOURCE: National Institutes of Health.

projects budgeted and justified as such and those in support of the Department's national security missions.¹ With the primary focus upon preventive medicine and the medical problems of military operations, the Department of the Army accounts for roughly two-thirds of Defense Department funds for medical and health-related research. The remaining one-third is divided among the Department of the Navy with 20 percent of the total, the Air Force with 8 percent, and the Defense Atomic Support Agency with 6 percent.

Broadly speaking, the purposes of these research activities are to facilitate (1) more effective performance of the Armed Forces under widely divergent environmental conditions and (2) recovery from injury or illness. The substance of the research in the former category encompasses maintenance of the individual under abnormal atmospheric and gravitational conditions, protection from hazards such as physical and psychological trauma, toxic agents, adverse climate, and determination of fitness for performance in specific environments. Research in the second category stresses the development of new knowledge and methods adaptable for use under field conditions.

In 1962 the *Department of Agriculture* will spend

¹ Because of budget structuring, pay and allowances of military personnel assigned to work on all medical and health-related projects are included in the totals for research projects directly related to health but not budgeted as such.

about \$20 million for research identified as medical and health-related in support of its responsibilities for the advancement of the Nation's agriculture and the welfare of the American farmer. These funds support research on diseases of livestock transmissible to man; toxicological effects of pesticide residues; crop research for the improvement of plants yielding chemicals for medicinal products; the biology, ecology, and prevalence of insects affecting man and animals; and problems in food and nutrition, including the physiological availability of nutrients in foods, the metabolic responses of humans to different combinations of dietary proteins and fats, the elimination of health hazards in the handling and processing of foodstuffs, and the protection of foods from spoilage and deterioration.

Pursuant to its statutory responsibility to support and encourage progress in all fields of science, the *National Science Foundation* allocated roughly \$12 million for medical research in the biomedical sciences in 1962. These expenditures support basic investigations in areas directly related to human health in scientific disciplines such as molecular biology, genetics, immunochemistry, and metabolic biology.

In furtherance of its space exploration missions, the *National Aeronautics and Space Administration* will devote about \$20 million in 1962 to research directly related to human health. As indicated by the success-

Table 5B
Percentage Distribution of Federal Expenditures for Conduct of Medical and Health-Related Research, 1960-62

Agency	1962			1961			1960		
	Total	Budgeted	Directly related	Total	Budgeted	Directly related	Total	Budgeted	Directly related
	(estimate)			(actual)			(actual)		
	100.0	100.0	100.0	100.0	100.0	100.0	¹ 100.0	¹ 100.0	¹ 100.0
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	¹ 100.0	¹ 100.0	¹ 100.0
Atomic Energy Commission.....	8.2	1.2	40.9	9.8	1.5	44.0	11.3	1.8	46.9
Federal Aviation Agency.....	.3	.3	.....	.4	.4	.....	.2	.3	.....
National Aeronautics & Space Administration.....	2.6	.....	14.7	.8	.....	4.3	.2	.....	.7
National Science Foundation.....	1.5	.....	8.4	2.1	.....	10.7	3.1	.....	14.7
Office of Emergency Planning ².....	.....	.....	.....	.1	.1	.....	.1	.1	.....
Veterans Administration.....	3.3	4.1	.....	3.2	4.0	.....	3.4	4.3	.....
Department of Agriculture.....	2.5	.....	14.3	3.1	.....	16.2	3.2	.....	15.2
Department of Defense.....	7.6	4.7	21.0	8.4	4.7	24.0	¹ 8.6	¹ 5.1	¹ 21.5
Department of Health, Education, & Welfare.....	73.8	89.6	.....	71.8	89.1	.....	69.5	88.2	.....
(National Institutes of Health).....	(65.7)	(79.8)	.....	(65.3)	(81.1)	.....	(63.0)	(79.9)	.....
Department of Interior.....	.1	.....	.7	.2	.....	.8	.2	.....	.7
Department of State.....	.1	.1	.....	.1	.2	.....	.2	.2	.....

¹ Data for 1960 were not furnished by the Defense Department; they are derived from estimates published in *Health Research and Training*, House Committee on Government Operations, House Report No. 321, 87th Congress, 1st Session, April 28, 1961, p. 11.

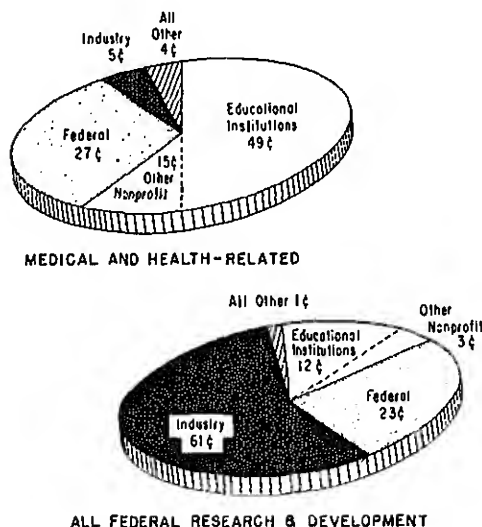
² Medical research activities merged with Defense Department in 1962.

Note.—Detail will not necessarily add to totals because of rounding.

SOURCE: National Institutes of Health.

Chart 4

1962 Federal R & D Dollar—Total, and Medical and Health-Related—Distributed by Performer



SOURCES: National Science Foundation, National Institutes of Health

simulate the stresses which can be anticipated and the means to withstand them; they probe for new knowledge about the psychophysiological concomitants of weightlessness, isolation, and confinement; the metabolic requirements of energy exchange, heat transfer, and nutrition under the limitations imposed by confinement in a space-capsule; and the radiation hazards in space. The agency is also pursuing the search for extraterrestrial life, to further our knowledge of life's origin and its evolution.

Distribution by Performer

About three-fourths of Federal funds for medical and health-related research flow to the Nation's scientists working in universities, medical schools, hospitals, research institutes, industry, or in foreign countries. Slightly over one-fourth of the total is spent in Federal laboratories and hospitals (table 6A).

This distribution of Federal support for medical and health-related research by performer contrasts sharply with the distribution of the Federal dollar for total R & D (chart 4).⁵ *Educational institutions* receive

⁵ Distribution of total Federal expenditures for research and development derived from National Science Foundation, *Federal Funds for Science X*.

ful orbital flights of America's astronauts, such research is crucial for the safety of man in space. Studies

Table 6A
Federal Expenditures for Medical and Health-Related Research, by Performer, 1962
(Thousands of dollars (Estimate))

Agency	Total	Federal	Other performers					Foreign
			United States					
			Industry	Nonprofit organization			All other ¹	
				Total	Educational institutions	Other		
Total.....	\$789,561	\$210,449	\$39,195	\$506,506	\$384,863	\$121,643	\$12,868	\$20,543
Atomic Energy Commission.....	64,679	5,617	12,937	42,682	32,028	10,654	150	3,293
Federal Aviation Agency.....	1,870	1,664	13	193	143	50	.....	.....
National Aeronautics & Space Administration.....	20,620	4,540	² 8,040	² 8,040	² 8,040	.....	.....	.....
National Science Foundation....	11,660	422	.....	10,935	10,311	624	18	285
Veterans Administration.....	26,429	25,197	246	986	655	331	.....	.....
Department of Agriculture.....	19,950	16,604	.....	3,186	3,186	.....	.....	160
Department of Defense.....	59,898	39,075	3,211	17,072	14,135	2,937	20	520
		116,035	14,748	423,331	316,285	107,046	12,155	16,285
		² 274)	(14,149)	(393,681)	(296,605)	(97,076)	(8,184)	(14,445)
		710	.....	.....	.....	.....	.....	.....
		385	.....	81	80	1	525	.....

Distribution of Federal Expenditures for Medical and Health-Related Research, 1962

[Estimate]

Percent distribution by agency

Agency	Total	Federal	Other performers					
			United States					Foreign
			Industry	Nonprofit organization			All ¹ other	
				Total	Educa- tional insti- tutions	Other		
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Atomic Energy Commission.....	8.2	2.7	33.0	8.4	8.3	8.8	1.2	16.0
Federal Aviation Agency.....	.2	.8	.0	.0	.0	.0	.....	.....
National Aeronautics & Space Administration.....	2.6	2.1	² 20.5	² 1.6	² 2.1	.....	.....	.....
National Science Foundation...	1.5	.2	.....	2.2	2.7	.5	.1	1.4
Veterans Administration.....	3.4	12.0	.6	.2	.2	.3	.....	.....
Department of Agriculture.....	2.5	7.9	.....	.6	.8	.....	.....	.8
Department of Defense.....	7.6	18.6	8.3	3.4	3.7	2.4	.2	2.5
Department of Health, Educa- tion, & Welfare.....	73.8	55.1	37.6	83.6	82.2	88.0	94.4	79.3
(National Institutes of Health).....	(65.7)	(41.9)	(36.1)	(77.7)	(77.1)	(79.8)	(63.6)	(70.3)
Department of Interior.....	.1	.4	.....	.....	.....	.....	.....	.....
Department of State.....	.1	.2	.....	.0	.0	.0	4.1	.....

Percent distribution by performer

Total.....	100.0	26.7	5.0	64.1	48.7	15.4	1.6	2.6
Atomic Energy Commission.....	100.0	8.7	20.0	66.0	49.5	16.5	.2	5.1
Federal Aviation Agency.....	100.0	89.0	.7	10.3	7.6	2.7		
National Aeronautics & Space Administration.....	100.0	22.0	² 39.0	² 39.0	² 39.0			
National Science Foundation...	100.0	3.6		93.8	88.4	5.4	.2	2.4
Veterans Administration.....	100.0	95.3	.9	3.8	2.5	1.3		
Department of Agriculture.....	100.0	83.2		16.0	16.0			.8
Department of Defense.....	100.0	65.2	5.4	28.5	23.6	4.9	.0	.9
Department of Health, Educa- tion & Welfare.....	100.0	19.9	2.5	72.7	54.3	18.4	2.1	2.8
(National Institutes of Health).....	(100.0)	(17.0)	(2.7)	(75.9)	(57.2)	(18.7)	(1.6)	(2.8)
Department of Interior.....	100.0	100.0						
Department of State.....	100.0	38.8		8.2	8.1	.1	53.0	

¹ Includes State and local governments.

² Estimated distribution of nonfederal performers.

SOURCE: National Institutes of Health.

health-related research, as contrasted with nearly three-fifths of Federal expenditures for total R & D.

Expressed in dollar terms, Federal agencies spend \$210 million to finance research conducted by Federal scientists working in federally operated laboratories and hospitals. The Department of Health, Education, and Welfare accounted for nearly three-fifths of this total, the Department of Defense approximately one-fifth, the Veterans Administration over one-tenth, with the balance scattered among the remaining agencies (table 6B). About \$580 million, or more than 2.5 times that amount, went for the support of medical and health-related research performed by scientists and clinicians working in nonfederal laboratories.

Nonprofit institutions received more than \$500 million, or seven-eighths of this amount. Indeed, it should be noted that well over 60 percent of all Federal funds devoted to medical and health-related research in 1962 were concentrated in the nonprofit sector. Research grants awarded by the National Institutes of Health, the principal medical research agency of the Government, constitute the predominant source of support for medical and health-related research performed in nonprofit institutions, providing three-fourths of all Federal funds. These research grants provide support for thousands of scientists and clinicians working on fundamental inquiries touching every facet of biology and medicine in hundreds of different institutions.

To strengthen the Nation's research structure and to provide the necessary resources for modern scientific research, NIH also awards grants for (1) general support of research and research training programs of institutions and (2) clinical research centers which create the environment essential for more precise observation and control in clinical studies. Because advances in knowledge of the biological characteristics of species structurally and physiologically similar to man may yield results useful for the prevention and treatment of human disease, NIH also supports regional centers for the study of subhuman primates.

Industrial firms received \$40 million in Federal contracts for medical and health-related research. More than one-third of this total, \$14 million, represents the NIH-sponsored testing of new drugs and chemical compounds for use in the treatment of cancer and other diseases. AEC research contracts account for another \$13 million—about 30 percent of the total. And the remaining one-third is made up of NASA and Defense-sponsored research conducted by industry.

Agency, and the Departments of Agriculture and Defense each spent two-thirds or more of their funds on medical and health-related research in their laboratories. Other agencies such as the National Institutes of Health, the Atomic Energy Commission, and the National Science Foundation devote at least two-thirds of their research support to nonprofit institutions.

The National Institutes of Health and the other agencies together provide 85 percent of the funds for medical and health-related research performed for the Federal Government in *foreign countries*. NIH support of research activities approached \$15 million—70 percent of the total in 1962. In addition to the \$15 million in grants to investigators in foreign countries, research activities financed through foreign currency made available to NIH under the P.L. 480 program amounted to an additional \$3 million. Because P.L. 480 funds are primarily extensions of work underway in NIH laboratories and, in general, are responsive to the guidance and direction of Federal scientists, these funds are included in the Federal aggregate reported in the study.

Field of Science

Medical and health-related research increasingly draws upon all fields of science to cope with the problems of health and disease. While this is so, the preponderance of such research is deeply rooted in biology and medicine. At the same time, tools and concepts of the physical sciences—physics, chemistry, mathematics, and engineering—increasingly find greater application in the study of health-related phenomena.

In 1962, roughly 90 percent, or \$710 million, of the funds for medical and health-related research was classified in the biological and medical sciences (table 7). This aggregate does not portray the broad diffusion of research among the many disciplines of biology—such as biochemistry, biophysics, pharmacology, general microbiology, pathology, and the specialties of medicine such as cardiology, neurology, pediatrics, psychiatry, and surgery.

The remaining 10 percent—\$80 million—was spread over the other fields of science and scattered among the several agencies. The social and behavioral sciences represented roughly one-half of this total, the physical sciences accounted for about one-third, and all other fields comprised the balance. As indicated in table 7, the larger Federal programs, such as the

involved the productive participation of virtually all fields of science.

Research projects in other physical sciences—including mathematics and engineering—are supported primarily by the Atomic Energy Commission and by DHEW's Food and Drug Administration and Bureau of State Services. The Veterans Administration program for the development of prosthetic devices also entails some support for medical engineering.

Agencies of the Department of Health, Education, and Welfare provide virtually all (99 percent) of the funds for investigation in the social sciences relevant to medical and health-related research.

Medical and Health-Related Research Facilities

Federal agencies will spend \$70 million this year for the construction of facilities for medical and health-related research (table 8). This represents 8 percent of Federal funds for medical and health-related research in 1962, as compared with 10 percent in 1960. Three-fifths of this \$70 million will be used to expand the Nation's physical resources for research at universities, hospitals, and other non-Federal installations throughout the country. About two-fifths of the total, or \$27 million, will be spent for the construction and expansion of Federal research facilities.

construction of health research facilities at nonfederal public and private nonprofit institutions. These amounts represent matching grants awarded under the Health Research Facilities Program. Funds are provided following a determination that (1) the institution has the competence to conduct the type of health-related research for which the facility is to be constructed, (2) the proposed facility will be used for health-related research for at least 10 years, and (3) the Federal share of the costs of the research facility portion of the proposed construction shall not exceed 50 percent. For 1963 the President's Budget includes a request for \$50 million for this program—an increase of \$20 million above the current level.

NOTE ON DEFINITIONS AND METHOD

Definitions

In general, the definitions of "conduct of research and development," "obligations," "field of science," "performer," and "expansion of facilities" are those employed by the National Science Foundation in its annual surveys and published in *Federal Funds for Science X*, pp. 62ff.

Because medical and health-related research comprises a broad area of scientific inquiry aimed ultimately at the improvement of human health and the

Table 7
Federal Expenditures for Medical and Health-Related Research, by Field of Science, 1962
[Thousands of dollars (Estimate)]

Agency	Total	Bio- logical	Medical	Agricultural	Psycho- logical	Physical sciences				Social	Other
						Total	Physical sciences proper	Math- ematical	Engi- neering		
Total.....	\$789,561	\$95,302	\$613,504	\$2,746	\$29,666	\$24,504	\$18,485	\$519	\$5,500	\$15,022	\$8,817
Atomic Energy Commission.....	64,679	37,195	18,178	1,605	.....	7,701	7,701	.....	.....	.....	.....
Federal Aviation Agency.....	1,870	.....	1,870	.....	.....	.....	.....	.....	.....	.....	.....
National Aeronautics & Space Administration....	20,620	8,220	7,400	.....	5,000	.....	.....	.....	.....	.....	.....
National Science Foundation.....	11,660	9,242	1,660	.....	758	.....	.....	.....	.....	.....	.....
Veterans Administration....	26,429	.....	23,962	.....	1,763	704	.....	.....	704	.....	.....
Department of Agriculture....	19,950	6,967	12,193	332	.....	383	200	.....	183	75	.....
Department of Defense.....	59,898	13,081	43,388	453	1,270	1,406	691	234	481	.....	300
Department of Health, Education, & Welfare... (National Institutes of Health).....	582,554 (518,733)	20,571 (13,136)	503,793 (471,500)	356	20,875 (20,215)	13,495 (178)	9,389	285	3,821	14,947 (13,704)	8,517
Department of Interior....	910	26	69	.....	.....	815	504	.....	311	.....	.....
Department of State.....	991	.....	991	.....	.....	.....	.....	.....	.....	.....	.....

SOURCE: National Institutes of Health.

Federal Expenditures for Construction of Facilities for Medical and Health-Related Research, 1961-62

[Millions of dollars]

Agency	1962 (estimate)			1961 (actual)		
	Total	Federal site	Other	Total	Federal site	Other
Total.....	\$67.8	\$27.1	\$40.6	\$53.4	\$11.8	\$41.6
Atomic Energy Commission.....	3.6	.....	3.6	4.8	.....	.....
National Aeronautics & Space Administration.....	.8	.8	.....	.....	.....	.....
National Science Foundation.....	2.0	.....	2.0	1.7	.....	.....
Veterans Administration.....	5.6	5.6	.....	5.8	5.8	.....
Department of Agriculture.....	3.3	3.3	.....	.6	.6	.....
Department of Defense.....	2.5	2.5	.....	2.4	2.3	.....
Department of Health, Education, & Welfare.....	49.9	14.9	35.0	38.1	3.1	35.0
(National Institutes of Health).....	(42.7)	(7.7)	(35.0)	(37.5)	(2.5)	(35.0)

Note.—Detail will not necessarily add to totals because of rounding.

SOURCE: National Institutes of Health.

conquest of disease, it draws upon all fields of science—life, physical, engineering, psychological, and social—and many disciplines within each field. Within this broader context, "medical and health-related research" is defined as all systematic study directed toward the development and use of scientific knowledge through fundamental research in the laboratory, clinical investigations, clinical trials, epidemiological studies, and engineering studies in the following areas:

1. The causes, diagnosis, treatment, control, prevention of, and rehabilitation relating to the physical and mental diseases and other killing and crippling impairments of mankind;

2. The origin, nature, and solution of health problems not identifiable in terms of disease entities;

3. Broad fields of science where the research is undertaken to obtain an understanding of processes affecting disease and human well-being;

4. Research in nutritional problems impairing, contributing to, or otherwise affecting optimum health;

5. Development of improved methods, techniques, and equipment for research, diagnosis, therapy, and rehabilitation.

Distinction between "budgeted" and "directly related medical research." In order to ensure coverage of the entire range of medical and health-related research, obligations for research budgeted and supported as medical and health-related were reported separately for the following two categories which are essentially determined by the purpose for which research is supported:

1. **Obligations for Budgeted Medical and Health-Related Research.** This includes obligations for funds separately budgeted for medical and health-related research and specifically identified, programmed, and justified as such within the Executive and Legislative Branches and to the public at large. Such research is supported for the purpose of improving human health, and may include all the research activities of agencies or subagencies whose sole mission is the advancement of human health through research.

2. **Obligations for Research Activities Directly Related to Medical and Health-Related Research.** This includes obligations for research which is directly related to health in terms of substance or problem applications, but which derives from funds budgeted, justified, or supported for purposes other than medical or health objectives; for example, the general support of science, the promotion of American agriculture, the achievement of the Nation's national purposes in outer space.

Method

In order to meet the need for authoritative definitive measurement of the Nation's expenditures for medical and health-related research, the National Institutes of Health has maintained a time series showing separately the expenditures of government (Federal, State, and local) and nongovernment sources (industry, foundations, health agencies, and a number of other private sources). However, medical and health-related research conducted by Federal agencies

was not fully reflected in the national series because of certain inadequacies in the existing data and reporting method. Thus, the need to refine both the scope and method of measuring Federal support of medical and health-related research, to insure complete coverage, was long recognized by the National Institutes of Health.

Existing deficiencies were also noted in the reports of two congressional committees; each recommended that NIH take action to remedy the situation. (See Senate Committee on Government Operations, "Health Activities of the Federal Government," Senate Report No. 142, 87th Congress, 1st Session, March 30, 1961; and House Committee on Government Operations, "Health Research and Training," House Report No. 321, 87th Congress, 1st Session, April 28, 1961.)

Taking account of these recommendations and the growing concern of the President's Science Advisory Committee, the Bureau of the Budget requested the National Institutes of Health to undertake a survey of Federal agencies engaged in medical and health-related research. For this survey, Federal agencies were requested for the first time to review their research projects—and to report obligations for medical and health-related research—distinguishing between monies budgeted for medical and health-related research as

such, and funds spent for research directly related to health but supported for other purposes (see definitions above). NIH was asked to collect actual obligations for fiscal year 1961, and estimated obligations after apportionment for fiscal year 1962. Using similar guidelines, Bureau of the Budget examiners compiled summary data for fiscal year 1963.

In recognition of the magnitude and importance of Federal support for medical and health-related research, the Bureau of the Budget included a section delineating medical and health-related research activities in the *Special Analysis on Federal Research and Development Programs* published in the Budget Document, using for this purpose the summary statistics collected in the survey. The Bureau of the Budget has made the 1963 data available to NIH for use in this publication. The detailed data on expenditures for medical and health-related research, by performer and field of science, and for expansion of research facilities are published for the first time in this *Report*. Revised data for earlier years, based on the same distinction between medical and health-related research budgeted as such and that directly related to human health but supported for other purposes, will be compiled so that a comparable historical time series can be made available.